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ABSTRACT

Technology, defined as power to build or to destroy, affects both the natural and social environments. Technological societies are characterized by five elements: green revolution, industry, medicine, biology, and space technology. To demonstrate that individuals and groups perceive the effects of these aspects differently, a summary of nine pro and ten con viewpoints is presented. In order for students to cope with changing technologies and their impact on the present and future world, they need to acquire the knowledge, thinking skills, participation skills, and commitment to civic action which will help them become responsible global citizens. A "Proactive Action Model" is presented as one means of achieving this goal along with a sample unit on modern technology's effects upon the natural and human environment. (DC)

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Twenty-First Century Technology and the Global Environment: Developing A 'Cause/Effect Relationship' Perspective Among Proactive Action Students

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GLOBAL HORIZONS

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ABOUT THE AUTHOR

Richard O. Peters received his Bachelor of Science in Education and Master of Education degrees from The University of Maine (Orono); pursued doctoral studies at The Florida State University (Tallahassee); and was granted the Doctor of Education degree from The University of Rochester (NY).

Dr. Peters has been involved with the development of environmental education and global studies programs (Kindergarten through grade twelve), has developed and presented 'how to do it' workshops for elementary/ secondary grade teachers, and has been published by several national periodicals.

ERIC documents developed by Dr. Peters include:

Progress Toward A Global Perspective of Environmental Quality: Strategies To Affect Student Awareness of the Environment (December 1978) ED 157 689

A View of Tomorrow's World: The Need To Develop Student Perceptions of Global Interdependence and Environmental Stewardship (November 1981) ED 204 174

Infusing Global Awareness Components of Environmental Education Into The K-12 Social Studies Curriculum for Purposes of Affecting Student Attitudes and Perspectives (December 1981) ED 205 392

Teaching Students To Be Proactive Change Agents In A Global Age: A New Direction for Preservice and Inservice Teacher Education (February 1982) ED 207 952

STATEMENT

Technology has been defined as power; power to build or to destroy. It includes all human-made tools, methods, and processes.

Any given technology has neither a good nor an evil purpose - apart from the purpose that its uses has in mind.

We move into the last decades of the twentieth century with greater technological skill than could have been dreamed of in years past.

TWO SIDES OF THE COIN: PROS and CONS

Today, critics and supporters of the technology revolution hold firmly to their perceptions of this human-made phenomena, and its effects on both natural (ecosphere)[1] and social (human-made) environments.

Any given technological society is in perpetual change; things are always in flux and events are often unpredictable. Among the characteristics of technological societies are:

a) Green Revolution - plant genetics and the production of fast-growing, high-yield crops.

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1 The natural environment in which humans live; all the plant and animal life, including man, and the various natural phenomena of air, land and water are systemically interrelated.

b) Industry - computerized processes and mass production of diverse goods.

c) Medicine - wonder drugs such as penicillin and antibiotics to conquer dreaded diseases.

d) Biology - DNA research and genetic engineering.

e) Space Technology - satellite communication systems to link the nations/peoples of the world.

PROS.

1) Technology can be used by LDC's (less-developed countries) to improve standards-of-living for their people, to better utilize native natural resources, to develop industrial capabilities, and to participate in international programs for global betterment as well as in global policy decision making activities such as the United Nations Conference On Science And Technology For Development (1979).

2) United States Senator William Spong (1970) stated that the development of ocean resources is one of the urgent tasks facing the nation and the world. Humans are knowledgeable about the full potential of its vast resources and have developed the technology necessary to exploit them. Aquaculture, for example, could greatly augment the production of traditional fishing.

Achievements in marine development point up the tremendous economic potential of that two-thirds of the earth which lies beneath the sea.

3) Modern technology has improved both the quality and qualtity of goods and services which have been made available to more people - worldwide.

4) René Dubos is of the opinion that humans are now learning to anticipate many of the effects of social and technological innovations before they are put into effect, and that we are better able to develop protective measures against the dangers of these innovations. The world has begun to develop and accept new forms of energy before the reserves of fossil fuels are exhausted. The improvements in environmental quality which have been recently achieved can also be regarded as examples of adaptation to the future.

5) Medical technology can prevent such deadly diseases as polio and smallpox. It has reduced infant deaths and has lengthened the life span of people in even the poorest countries. Technology of the space age has not only landed people on the moon but also has produced many direct benefits such as weather satellites.

6) From the food one buys in the supermarket to the light and heat in one's home, most of the things humans depend upon for a comfortable life owe their existence to modern technology.

7) According to Dieter Ehrhardt (1981) most food production experts agree that the agricultural technology exists to produce sufficient food for six to eight billion people.

8) As stated in Popline (October 1981) manufacturing industries are expanding in developing countries and can be expected to provide some relief to the problems of overpopulation by creating employment opportunities for the growing urban populations.

9) As reported in The Wall Street Journal (February 1982) the use of underwater cameras to photograph in drill holes reduces costly guessing. Drilling success rates are rising - thanks to advanced techniques and specialized tools. This degree of success would not be possible without recent technological advances in geophysics.

cont.

1) In 1971, Ian K. MacGregor stated that although the world's rapidly expanding population depends litterly on industrial technology to produce the goods and agricultural products required to meet its growing needs and desires, the world has now discovered that it must urgently learn how to avoid or how otherwise to deal with the dangerous secondary effects of technology itself.

2) In the words of Barry Commoner (1974) the earth is polluted neither because man is some kind of especially dirty animal nor because there are too many of us. The fault lies with human society - with the ways in which society has elected to win, distribute, and use the wealth that has been extracted by human labor from the planet's resources. In modern industrial societies the most important link between society and the ecosystem on which it depends is technology. Many of the new technologies which now dominate production in DC's (developed countries) are in conflict with the ecosystem. They degrade the environment.

3) Environmental degradation is defined as any action that makes the environment less fit for human life. Jonathan Turk has identified three main categories of degradation.

Pollution - the contamination of the environment by the introduction of impurities.

Depletion of Resources - exploitation and overuse of nature's finite and renewable resources.

Disturbance of the Natural Condition - an upsetting of nature's scheme and cycles as a result of human action.

Most major environmental problems are caused by twentieth century technology People use the products of technology and are the cause of contemporary environmental problems.

4) In 1978, Barbara Blum (U.S. Environmental Protection Agency) stated that the science, industry and technology that have given us abundance beyond our ancestors' wildest dreams have also presented us with the unwelcome by-product problems that have been created in this affluence process.

5) Ted Howard (1980) stated that for three billion years life has evolved through the random process of natural selection and mutation. Now, the growing technological science of genetic engineering has brought humankind to the brink of systematically intervening in that process, disrupting billions of years of evolutionary wisdom, and literally taking into our hands the ultimate power of defining the

gene pool and directing the evolution of all forms of life.

6) Technology can help keep us supplied with minerals and energy, but new technological processes usually require large amounts of energy. As technology becomes more complex, you have to put more and more energy into a process for each unit of production achieved.

7) A major problem in the age of technology is protection of the environment. Almost every new technology seems to bring new pollutants. There is a limit to the amount of pollutants the environment can absorb and break down into harmless substances.

8) New technologies are extremely expensive. They require great amounts of capital investment to make them operational. Most of the money required to support these new technologies is in the industrialized countries of the world. At the same time, great supplies of mineral and fuel resources remain untapped in the nonindustrialized countries.

9) The technology used to put humans on the moon has been incorporated into a new generation of missiles and tools of war. The pesticides that have increased food crops have also polluted bodies of water. Modern transportation has been

accompanied by air pollution, destruction of rural environments, traffic jams, noise, and much greater dependency on nonrenewable resources.

10) As projected by the Council On Environmental Quality (1980) the most serious environmental development (by the year 2000) will be an accelerating deterioration and loss of the resources essential for agriculture - due to the use of modern technological methods/processes. The Global 2000 Report notes that this serious environmental development will include soil erosion, loss of nutrients, increasing salinization of both irrigated land and water used for irrigation, loss of high-quality cropland to urban development, crop damage due to increasing air and water pollution, extinction of local and wild crop strains needed by plant breeders for improving cultivated varieties, and more frequent and more severe regional water shortages - especially where energy and industrial developments compete for water supplies, or where forest losses are heavy and the earth can no longer absorb, store, and regulate the discharge of water. Likewise, water pollution in less-developed countries is expected to worsen as the urban population soars and industry expands. Air quality (especially in industrialized countries) is likely to worsen as increased amounts of fossil fuels, especially coal, are burned.

The risk of radioactive contamination of the environment, due to nuclear power reactor accidents, will be increased as will

the potential for proliferation of nuclear weapons.

Pollution by salts, acid rain, pesticides, and other toxic chemicals are profoundly affecting freshwater ecosystems throughout the world.

ALTERNATIVE FUTURES[2]

As we rapidly approach the year 2000 we must strive to educate tomorrow's global citizens re alternative futures. According to The Global 2000 Report to the President, barring revolutionary advances in technology - life for most people on earth will be more precarious in 2000 than it is now.

It is essential that today's education programs not only introduce students to tomorrow's world but also instill in them critical thinking and decision making skill abilities -- so that they can adapt to change (and to new knowledge acquisition as well) and at the same time continue to function as vital citizens of the ever-changing world.

In 1981, the National Council for the Social Studies (NCSS) enumerated the essentials of social studies programs (K-12). According to NCSS, effective social studies programs help prepare young people who can identify, understand and work to solve the problems that face our increasingly diverse nation and interdependent world. Such programs must deal with critical issues and the world as it really is, prepare students to make decisions and lead them toward citizenship participation in public (global) affairs.

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[2] Possible forthcoming developments. The future is not fixed; many things may occur and people should explore the various possibilities and then seek to realize those that seem most desirable.

Students need knowledge of the world at large and the world at hand, the world of institutions and the world of individuals, the world past - the world present - the world future; world-wide relationships of all sorts between and among nations, races, cultures and institutions. It is time for us to recommit ourselves to strong education for civic responsibility (on a global scale).

The Preactive Action Model for learning, skills development, and skills application in real and vicarious situations relates to many of the enumerated essentials of an exemplary social studies program.

1) Knowledge: link information presented in the classroom with experiences gained by student through social and civic observation, analysis and participation.

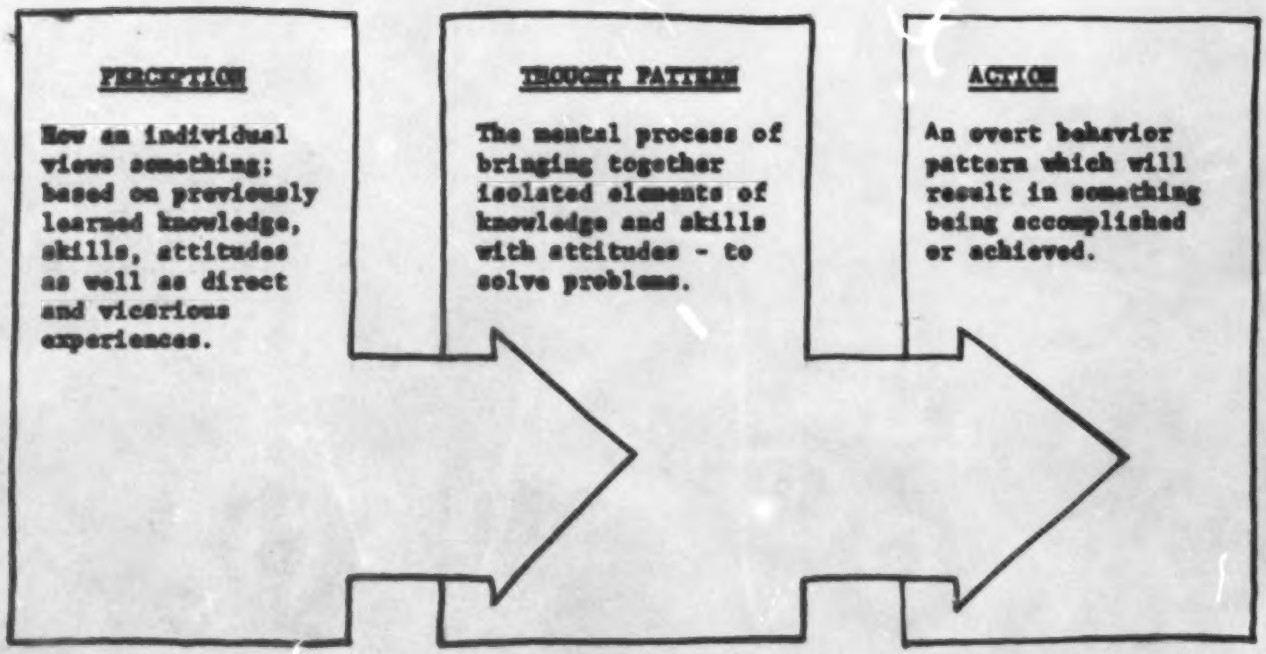
2) Thinking Skills: it is important that students connect knowledge with beliefs and action. Thinking skills can be developed through constant systematic practice throughout the years of formal schooling.

   a) data gathering skills
   b) intellectual skills
   c) decision making skills
   d) interpersonal skills

3) Participation Skills: the individual uses the knowledge, beliefs, and skills learned as the basis for action. Connecting the classroom with the community provides many opportunities for students to learn the basic skills of participation.

4) Civic Action: combining the acquisition of knowledge and skills with an understanding of the application of personal beliefs to life through practice at social participation.

Proactive Action Model


PERCEPTION
How an individual views something; based on previously learned knowledge, skills, attitudes as well as direct and vicarious experiences.
THOUGHT PATTERN
The mental process of bringing together isolated elements of knowledge and skills with attitudes - to solve problems.
ACTION
An overt behavior pattern which will result in something being accomplished or achieved.

PROACTIVE ACTION STUDENTS

Proactive action students are individuals who; when properly equipped with knowledge, skills, and positive attitudes toward global stewardship, perceive problems facing humankind and the earth, research these problems and analyze data, critically assess alternative courses of action, and then make a commitment to act. Proactive action individuals are change agents !

SAMPLE UNIT

AREA OF STUDY: Modern Technology

CONCEPT: Effects Upon The Environments Of Humans And Nature

PURPOSE: To acquaint students with the positive/negative effects of modern technology upon the natural/social environments of the world - as well as human life styles.

GRADE RANGE: 7 - 12

ACTIVITIES:

1) Audiovisual software (e.g., films, filmstrips, slides, video tapes) are used to expose students to modern technology and its effects upon natural/social environments as well as human life styles.

2) Students select types of modern technology and research existing problems as well as benefits to humans and nature.

3) Students take field trips into the community to observe modern technology processes and effects upon environments and people.

4) Students investigate various types of technology and develop reports. Audiovisual software can be incorporated into the reports and/or presentations.

5) Guest speakers visit classrooms to discuss their experiences with technology and their training in the field.

6) Students are involved in a discussion group activity and in a decision making simulation. This activity can be filmed or video taped. (See PROACTIVE ACTION MODEL example)

7) Students collect pictures and draw pictures depicting technological processes and compile them into a bulletin board display.

8) Students conduct field-based technology studies within the community environment and make film/slide or video tape media 'productions'. These projects can be screened in the classroom and/or at community meetings.

9) Students study area technology problems, research possible solutions, and propose action plans. These solutions can be compiled into a plan and presented to governmental officials.

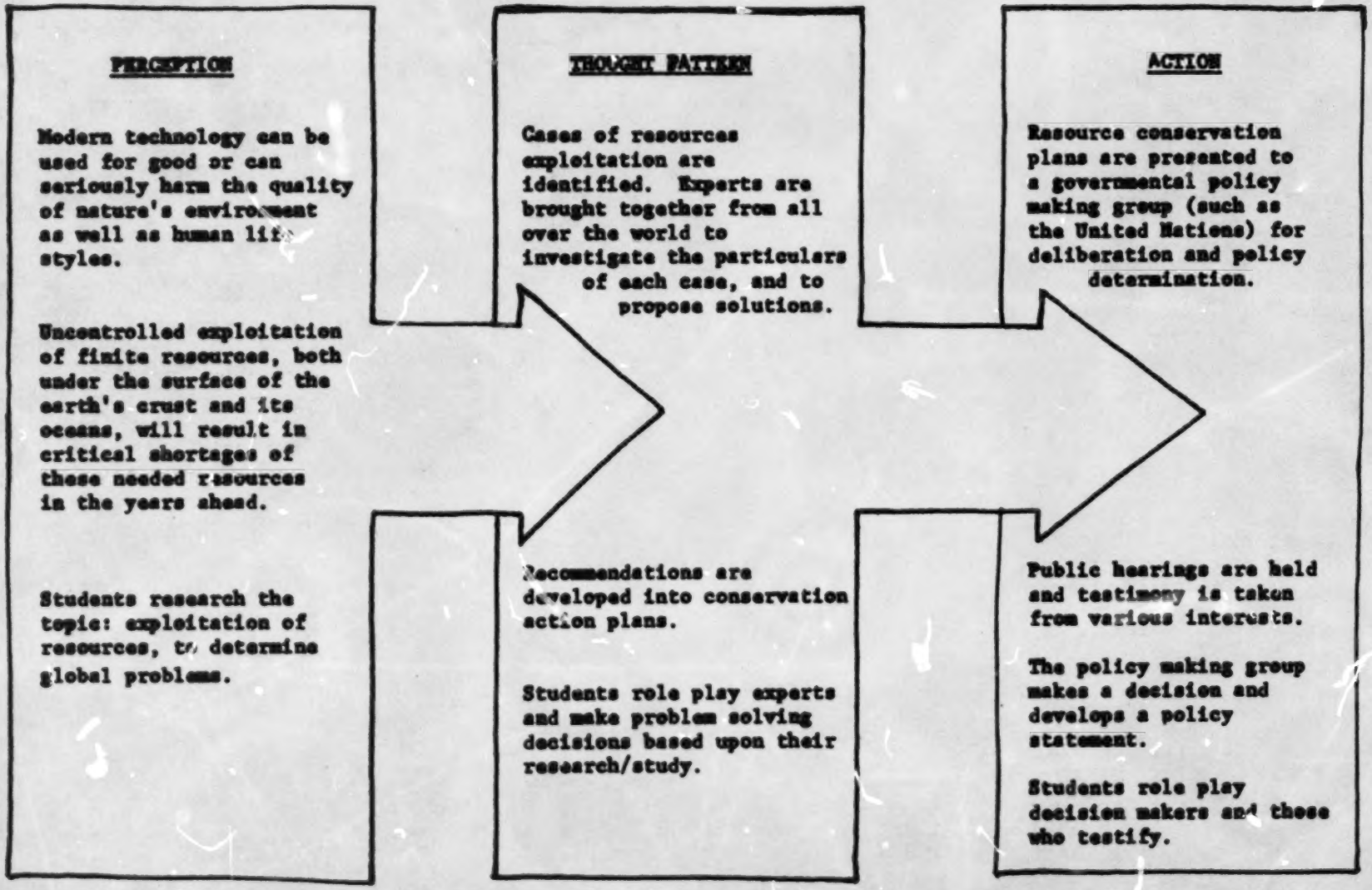
10) Students organize a technology career day. Representatives from several technology-based businesses/industries participate in career day activities; providing students with information about training/schooling opportunities.

11) Guest speakers visit classrooms to explain how modern technology can be/ has been used to solve human/environmental problems - worldwide.

12) Guest speakers visit classrooms to explain human/environmental problems caused by modern technology - worldwide.

NOTE: The activities listed herein are only suggestions which can be used by classroom teachers in any sequence so desired. Other activities not listed may be added - at the discretion of the classroom teacher.

Proactive Action Model
Example


PERCEPTION
Modern technology can be used for good or can seriously harm the quality of nature's environment as well as human life styles.
Uncontrolled exploitation of finite resources, both under the surface of the earth's crust and its oceans, will result in critical shortages of these needed resources in the years ahead.
Students research the topic: exploitation of resources, to determine global problems.
THOUGHT PATTERN
Cases of resources exploitation are identified. Experts are brought together from all over the world to investigate the particulars of each case, and to propose solutions.
Recommendations are developed into conservation action plans.
Students role play experts and make problem solving decisions based upon their research/study.
ACTION
Resource conservation plans are presented to a governmental policy making group (such as the United Nations) for deliberation and policy determination.
Public hearings are held and testimony is taken from various interests.
The policy making group makes a decision and develops a policy statement.
Students role play decision makers and those who testify.

REMARKS

Technology is merely a tool; simple or sophisticated in nature, which can be used for good or misused for evil -- whatever humans decide to do with it.

At times, what is designed for good deeds and intended to do good work results in by-products and spinoffs of harm. It is at this point in technological conceptualization, design, and implementation that humans must carefully monitor systems and processes -- making critical decisions to either proceed as planned or to modify and adapt designs/processes to fit existing circumstances and situations, worldwide.

It is the responsibility of human beings, both within and outside the technology community, to constantly oversee designs and processes. For example, the current concern over the design, construction, and operation of nuclear power plants in the United States and in other countries.

In order to successfully undertake a 'policing' responsibility, humans must be equipped not only to recognize and comprehend problems but must also possess the abilities, insights, and skills needed to analyze, critically think, make decisions -- and then to act in proactive ways.

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